A Global Comparison of Ekman Pumping From Satellite Scatterometers and Ocean Data Assimilation Estimates

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Ekman pumping, a form of wind-driven upwelling, plays important roles in upper-ocean dynamics, thermodynamics, and biology as well as in boundary-layer meteorology. Inverse models, such as those of ECCO (Estimation of the Circulation and Climate of the Ocean), estimate wind forcing through ocean data assimilation. Scatterometer data provide a stringent test of the skill of the assimilation in estimating wind. Ekman pumping obtained from various scaterometers are compared with those derived from ECCO model which assimilate TOPEX-derived sea level anomalies using the adjoint and Kalman filter/smoother methods. Differences in Ekman pumping between scatterometer and assimilation estimates are quantified in terms of the mean, standard deviation, and correlation. Change in Ekman pumping due to the assimilation is analyzed to identify the spectral (frequency-wavelength) space over which the assimilation has significant impact. The comparison also highlights aspects where the ECCO model and assimilation schemes need improvement.